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(54) Composition for artificial tracks and other surfaces

(57) A composition e.g. for an artificial track comprises a blend of a hydrocarbon, particularly an alkane, with a polymer, particularly atactic polypropylene, as an aqueous emulsion. The emulsion has the particular advantage that it can be used without the need for heating. The emulsion may be mixed with aggregate, e.g. sand, and applied to a locus.

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COMPOSITION FOR AN ARTIFICIAL TRACK

This invention relates to compositions for artificial tracks. The invention also relates to processes for making compositions for artificial tracks. The invention further relates to processes for the preparation, stabilisation or rejuvenation of artificial tracks.

There are many circumstances in which tracks or similar particulate surfaces are used for sporting, other recreational or commercial purposes. Horse riding surfaces generally comprise about 10 cm or more in thickness of particulate material such as sand, plastic granules, cinders, ash or particulate bark laid over a firm well-drained base. The riding surface may be the surface of a manege or of a track such as an all-weather gallop or race course. Other uses for such surfaces and tracks include uses as sports tracks, cycle tracks, motor racing tracks; and even footpaths or vehicle paths through forestry areas. Further uses of the present invention are in stabilising other weather affected surfaces and tracks, such as children's playgrounds; refuse sites; quarry sites and other mining areas. All such tracks and particulate surfaces are denoted herein by the term "artificial track". All such particulate materials are denoted herein as "track forming aggregate material".

If untreated, the artificial track can move. Regular use, for example, can cause material to be kicked to one side so as to leave ruts or depressions. Also, untreated track forming aggregate material can create a dust problem in some fields of use.

Proposals have been made for the treatment of artificial tracks to stabilize them. Spraying the surface of the artificial track with oil can lay the dust but does not reduce the problem of rutting to any significant degree. Sand or other track forming aggregate material can advantageously be treated by mixing a hydrocarbon oil with the sand in hot mix conditions, preferably in an asphalt mixing plant. Alternatively the sand or other track forming aggregate material can be laid on site untreated, and then subsequently sprayed with a hot dressing of the hydrocarbon oil. The temperature needed for both hot mixing and hot spraying to be effective is from 80°C to 160°C, to ensure a thorough coating of the particles of the track forming aggregate material of the loose surface. Hot mixing and hot spraying are both techniques which require operator skill and which involve relatively expensive

equipment. There is a need for a process which is as effective as the known hot treatment processes but which does not have the above mentioned drawbacks.

According to one aspect of the invention, there is provided a composition for an artificial track, comprising an aqueous emulsion of a blend of a polymer and a hydrocarbon. The hydrocarbon differs from the polymer.

The hydrocarbon may have a boiling point above 25°C, preferably above 50°C, more preferably about 90° and most preferably about 120°C. The hydrocarbon may be an aliphatic, alicyclic or aromatic hydrocarbon; it may be saturated or unsaturated. The hydrocarbon may be an alkene or an alkane; it is preferably an alkane. Preferably, the hydrocarbon has from 10 to 40 carbon atoms, more preferably from 15 to 40 carbon atoms, and most preferably from 21 to 36 carbon atoms. It is especially preferred that the hydrocarbon comprises a blend; for example, a blend of alkanes having from 21 to 36 carbon atoms; an example of such a hydrocarbon blend is an aliphatic process oil. A suitable example is commercially available from Mobil Oil Company Limited under the trade mark PROREX 33.

The polymer suitably has a relatively high tackiness: preferably this should be such that a composition in accordance with the present invention has a binding effect on the artifical track equivalent to that of 6 to 14 wt %, preferably from 8 to 10 wt % (eg 9 wt %) of water on a dry, untreated artifical track. Such polymers suitably have a hardness from 10 to 50, preferably from 15 to 40, especially from 20 to 30 (such as 25) d mm (ASTM D5) at 25°C. Useful polymers have a viscosity, within a temperature range from 105°C to 120°C, from 300k to 700k, preferably from 400k to 600k (such as 500k) cP. The polymer may contain a minor amount, for example up to 10 wt% of oligomeric or monomeric residues.

The polymer may be a homopolymer or a copolymer, suitably an addition homo- or copolymer, desirably a vinyl homo- or copolymer, and is preferably preparable from one or more alkene monomers. It may suitably be a blend of such polymers. Examples of suitable homopolymers include low density (high pressure) polyethylene; atactic polypropylene; and polybutylene. Examples of suitable homopolymers includes polyvinylacetate, ethylenevinylacetate; copolymers of ethylene with C_4 to C_{10} alpha-olefins (LLDPEs); and copolymers of propylene with ethylene, with butylene or with ethylene and butylene. It is preferred that the polymer

is an amorphous or an atactic homo- or copolymer preparable from one or more alkene monomers. It is particularly preferred that the polymer is a propylene hompolymer. The polymer is most desirably an atactic propylene polymer; VISCOPOL A, an atactic polypropylene blended or grafted with a minor amount of another polyolefin such as polyethylene available from Dussek-Campbell, is found to be very suitable. Polymers from the EASTOFLEX amorphous polyolefin range from Eastoflex are also found to be suitable.

It is necessary that the polymer is soluble in the hydrocarbon: the temperature at which the polymer is soluble may be above room temperature.

The polymer may comprise from 2 to 40 wt %, preferably 5 to 20 wt %, more preferably 8 to 12 wt % and most preferably 10 wt % of the combined weight of polymer and hydrocarbon.

The aqueous emulsion of the invention has the significant advantage that it can be used in relation to an artificial track without the need to be heated.

It is necessary to form the emulsion to include a stabilising additive in order to keep the emulsion stable after it has been formed. The stabilising additive comprises an emulsifier and may also comprise of viscosity modifier.

The emulsion is preferably a cationic emulsion. A suitable emulsifier comprises both an amine and an organic acid which may, at least in part, salify each other. Preferably, the amine component comprises a long chain, for example a C_{10} to C_{40}, preferably C_{20} to C_{40} amine. In this respect, C_{10} to C_{30} mono-substituted amine and C_{20} to C_{40} di-substituted amines have been found to be most suitable. The chain may be branched or unbranched and is preferably an alkyl group. Representative examples include mono-substituted alkylene diamines, especially N-alkyl propylene diamines such as N-arachidyl -1, 3- propylene diamine, N-behenyl -1, 3- propylene diamine, N-dodecyl -1, 2 - propylene diamine, and N-hexadecyl -1, 3- propylene diamine. They further include mono-substituted monoamines, especially N-alkylamines, such as N-dodecylamine, N-hexadecylamine, N-octadecylamine and N-eicosylamine. A particularly preferred amine component comprises a blend of N-alkyl propylene diamines having different alkyl groups. Examples of such a blend are commercially available as Diamine B11 from Akzo-Nobel or as Dinoram 42 from Elf Atochem.

Preferably, the organic acid component is a C_1 to C_{18}, preferably a C_1 to C_6,

organic acid. The acid may suitably be a carboxylic acid, especially a monocarboxylic acid. Representative examples include formic acid, acetic acid, propionic acid and butyric acid, preferably acetic acid.

The viscosity modifier, where present, preferably comprises a relatively short chain, or cyclic amine. Suitably the amine has up to 12 carbon atoms but a molecular weight which is lower than that of the amine component of the emulsifier. The amine may comprise an aliphatic, cycloaliphatic, aromatic and primary, secondary or tertiary amine. Representative examples include dicyclohexylamine, dimethylamino propylamine, 1-methyl-hexylamine, N-octylamine, N-dodecylamine, N-dodecyl 1, 3-propylene diamine, aniline, N (1-methylundecyl)1, 3-propylene diamine.

If the viscosity modifier is not an amine, then it is preferably selected from: a sodium containing viscosity modifier such as sodium phosphate, sodium tetraborate, and sodium hexametaphosphate.

The relative amounts of the polymer and hydrocarbon, the water, the emulsifier and the viscosity modifier are within the following broad ranges:

Polymer and hydrocarbon	:	10-50 wt %
Emulsifier	:	up to 10 wt %
Viscosity modifier	:	0-10 wt %
Water	:	up to 100 wt %

It is preferred that the relative amounts are within the following ranges:

Polymer and hydrocarbon	:	20-40 wt %
Emulsifier	:	up to 5 wt %
Viscosity modifier	:	0-5 wt %
Water	:	up to 100 wt %

The most preferred relative amounts are:

Polymer and hydrocarbon	:	25-35 wt %
Emulsifier	:	up to 2 wt %
Viscosity modifier	:	0.1-0.5 wt %
Water	:	up to 100 wt %

According to another aspect of the invention, there is provided a process for the preparation of a composition for an artificial track, which process comprises

dissolving a polymer in a hydrocarbon at an elevated temperature below the boiling point of the hydrocarbon and the polymer; and adding water thereto, with agitation, until an emulsion is formed.

Preferably the polymer is dissolved in the hydrocarbon at a temperature of 90°C to 140°C, most preferably 120°C.

The relative amounts of the components of the composition may be in the ranges described above.

Preferably the emulsion further includes a stabilising additive. The stabilising additive comprises an emulsifier and may also comprise a viscosity modifier as described above.

It is preferred that the viscosity modifier, where present, is added to the polymer and hydrocarbon before they are added to the water. It is preferred that part of the emulsifier is added to the polymer and hydrocarbon, and part of the emulsifier is added to the water, before the polymer and hydrocarbon and water are mixed together. In the most preferred embodiment the emulsifier comprises both an amine and a carboxylic acid: in this embodiment the amine may be added to the polymer and hydrocarbon, and the carboxylic acid may be added to the water, before the polymer and hydrocarbon and the water are mixed together.

Preferably the water is heated to a temperature of 75° to 95°C, more preferably 80° to 85°C, before forming the mixture described above. The polymer and hydrocarbon are preferably at a temperature 5° to 10°C above that of the water when it is added to the water: most preferably the polymer and hydrocarbon are at 85° to 90°C when added to the water.

Preferably the components of the mixture are stirred in a colloid mill or a high speed mixer (e g a Silverson-type mixer). The rate of stirring can be selected to obtain a good emulsion. Stirring is preferably carried out at 5000 to 7000 rpm, most preferably at 6000 rpm.

According to a further aspect of the invention, there is provided an artificial track comprising a minor amount of a composition as described above in combination with a major amount of a track forming aggregate material.

The track forming aggregate material forms the bulk of the track, and can be any material usually used in the formation of a track or road. Typically, the track forming aggregate material would be sand.

When the composition is laid directly on the ground (rather than being mixed with the track forming aggregate material prior to being laid), the track forming aggregate material comprises the material of the ground: this material may have been specially laid prior to laying the composition, or it may comprise the naturally occurring material of the ground.

Preferably the artificial track further includes an adhesion agent. The adhesion agent is suitably an amine, preferably a mono-amine, most preferably N-hydrogenated tallow alkyl amine or N-stearylamine; an example of such an amine is commercially available from Naykem Limited under the trade name MONO-REXINE or DI-REXINE and from Akzo-Nobel under the trade name REDICOTE N3O3. The adhesion agent is preferably added to the remainder of the components of the artificial track material immediately prior to laying the artificial track.

It is believed (though not ascertained) that the adhesion agent functions first to displace water from around particles of the track forming aggregate material, where present, and then creates weak chemical attachment between the polymer and/or hydrocarbon and the particles of the track forming aggregate material. Where this material contains a hydrophilic material (such as clay) it is found necessary first to overcome the hydrophilicity of the material. This may be done by utilising the adhesion agent in which case greater quantities are required than is otherwise the case. The quantity is determined by routine experimentation.

It is found that the amine component of the emulsifying agent can have, at least to some extent, an effect also as an adhesion agent. It is preferred, in order to avoid separate pre-treatment of the artificial track with an adhesion agent, or its blending with the composition of the invention immediately prior to treatment of the artificial track, to select the amine component of the emulsifying agent to maximise it s effect also on an adhesion agent.

This invention also provides a process for the preparation of an artificial track, which process comprises mixing a minor amount of the composition as herein described with a major amount of a track forming aggregate material; and applying the mixture to a locus. The invention also provides a process for the stabilization of, or rejuvenation of, an existing artificial track which process comprises applying to the artificial track, for example by spraying, a composition as herein described, so that after breakdown of the emulsion of the blend of the polymer and the

hydrocarbon the particles of at least the surface of the artificial track are bound together. In such processes the artificial track is suitably an equestrian riding surface; for example, a race track, all-weather gallop or manege. It is particularly preferred that the mixing and/or application is effected at ambient temperature. Suitably, an adhesion agent is present.

The invention further provides the use of the composition as herein described in forming an artificial track or in stabilising or rejuvenating existing artificial track; for example, by spraying the emulsion on to a locus comprising the existing artificial track.

An application of from 3.5 to 7 wt % (eg. 5 wt%) of the composition of the inventor by weight of the total amount of track forming aggregate material to be treated is generally suitable.

The following Example illustrates the invention.

EXAMPLE

An emulsion for an artificial track was prepared by the following method.

261g of PROREX 33 (a paraffinic process oil available from Mobil Oil Company limited) was added to a mixing vessel and heated to 120°C.

26g of VISCOPOL A (an atactic polypropylene blend available from Dussek Campbell) in pastillated form was added to the heated PROREX 33.

The mixture was stirred at 100 rpm, while the temperature was maintained at 120°C. After the VISCOPOL A was fully dissolved the temperature was lowered to 90°C.

8g of DIAMINE B11 (a N-alkyl propylene diamine available from Berol Noble) was added to, and dissolved in, the composition, while stirring was continued at 100 rpm. 3g of dicyclohexylamine was subsequently added to, and dissolved in, the composition, while stirring was continued at 100 rpm.

700g of water was added to a mixing vessel and was heated to 80° to 85°C, while being continuously stirred. After the water had reached 80° to 85°C, 2g of glacial acetic acid was added.

The composition containing DIAMINE B11 and the dicyclohexylamine was added to the mixture of water and acetic acid. The mixture was stirred at 6000 rpm

using a colloid mill. The temperature was maintained at 85°C.

When an emulsion was formed it was allowed to cool naturally.

The resultant material was an emulsion for an artificial track. In order to use the emulsion, it can be mixed with a track forming aggregate material (such as sand), and a binder material (such as mono-rexine), and then laid on the ground, where required; or alternatively, it can be laid directly on the ground, then mixed with the track forming material in situ. Unlike prior art compositions, it is not necessary to heat the emulsion during the formation of the artificial track.

CLAIMS

1. A composition for an artificial track, comprising an aqueous emulsion of a blend of a polymer and a hydrocarbon.

2. A composition according to claim 1, wherein the hydrocarbon has a boiling point above 120°C.

3. A composition according to claim 1 or 2, wherein the hydrocarbon is an alkane.

4. A composition according to any preceding claim, wherein the polymer is an addition homo- or copolymer.

5. A composition according to any preceding claim, wherein the polymer is a vinyl homo- or copolymer.

6. A composition according to any preceding claim, wherein the polymer is a homo- or copolymer formed from one or more alkene monomers.

7. A composition according to any preceding claim, wherein the polymer is a polypropylene homopolymer.

8. A composition according to any preceding claim, wherein the polymer is an atactic polymer.

9. A composition according to any preceding claim, wherein the polymer is soluble in the hydrocarbon.

10. A composition according to any preceding claim, wherein the polymer comprises from 8 to 12 wt % of the combined weight of polymer and hydrocarbon.

11. A composition according to claim 1, wherein the polymer comprises atactic

polypropylene and the hydrocarbon comprises a blend of alkanes having from 10 to 40 carbon atoms.

12. A composition according to any preceding claim, further comprising an emulsifier.

13. A composition according to claim 12, wherein the emulsifier includes N-alkyl propylene diamine.

14. A composition according to claim 12 or 13, wherein the emulsifier includes acetic acid.

15. A composition according to any preceding claim, further comprising a viscosity modifier.

16. A composition according to claim 15, wherein the viscosity modifier comprises dicyclohexylamine.

17. A composition according to claim 12 and 15, wherein the relative amounts of the composition, the water, the emulsifier and the viscosity modifier are within the following ranges (the total amounts of each component being selected to provide a total of 100 wt %):

Composition	:	25-35 wt %
Emulsifier	:	up to 2 wt %
Viscosity modifier	:	0.1-0.5 wt %
Water	:	up to 100 wt %

18. A process for the preparation of a composition for an artificial track, which process comprises:

dissolving a polymer in a hydrocarbon at an elevated temperature below the boiling point of the hydrocarbon and the polymer; and

adding water thereto, with agitation, until an emulsion is formed.

19. A process according to claim 18, wherein the polymer is dissolved in the

hydrocarbon at a temperature of 90° to 120°C.

20. A process according to claim 18 or 19, wherein an emulsifier is present.

21. A process according to claim 18, 19 or 20, wherein a viscosity modifier is present.

22. A process according to any of claims 18 to 21, wherein the water is heated to a temperature of 80° to 85°C before adding the composition.

23. A process according to any of claims 18 to 22, wherein the composition is at a temperature 5° to 10°C above that of the water when it is added to the water.

24. A process according to any of claims 18 to 23, wherein the components of the emulsion are emulsified in a colloid mill or a high speed mixer.

25. A process according to any of claims 18 to 24, wherein the emulsion is formed by stirring at between 5000 and 7000 rpm.

26. An artificial track comprising a minor amount of a composition according to any of claims 1 to 17 in combination with a major amount of a track forming aggregate material.

27. An artificial track according to claim 27, further including a binder.

28. A process for the preparation of an artificial track, which process comprises:
mixing a minor amount of a composition according to any of claims 1 to 17 with a major amount of a track forming aggregate material; and
applying the mixture to a locus.

29. A process for the stabilization of, or rejuvenation of, an existing artificial track which process comprises applying to the artificial track a composition according to

any of claims 1 to 17, so that after breakdown of the emulsion of the blend of the polymer and the hydrocarbon the particles of at least the surface of the artificial track are bound together.

30. A process according to claim 28 or 29, wherein the artificial track is an equestrian riding surface.

31. A process according to claim 28, 29 or 30, wherein the artificial track is a race track, all-weather gallop or manege.

32. A process according to claim 29, wherein the mixing and/or application is effected at ambient temperature.

33. A process according to claim 29 or 30, wherein an adhesion agent is present.

34. The use of a composition according to any of claims 1 to 17 in forming an artificial track.

35. The use of a composition according to any of claims 1 to 17 in rejuvenating existing artificial track.

36. A composition for an artificial track substantially as herein described with reference to the Example.

37. A process for making an emulsion for an artificial track substantially as herein described, with reference to the Example.

The Patent Office

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Application No:	GB 9617275.4	**Examiner:**	K. Macdonald
Claims searched:	1-37	**Date of search:**	22 October 1996

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): C3V(VAT,VCX,VDC)

Int Cl (Ed.6): C09K

Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2215731 A	(MCE) see Examples 1-4	1,26 an 28 at least
X	GB 1411855	(PHILLIPS) see Claim 1; Examples	1 and 18 at least
X	GB 714782	(ARMSTRONG) see Claims 1,2; Example II	1 at least
X	US 4780233	(BETZ) see column 4, lines13-49	1 at least
X	US 4598019	(NIPPON) see Claim 1	1 at least
X	US 3887506	(TERRA PERMA) see Claim 1; column 3, lines 39-47	1 at least
X	US 3825513	(ROSTLER) see Claim 1	1 at least
X	US 3645947	(QUIGG) see Claim 1	1 at least

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.